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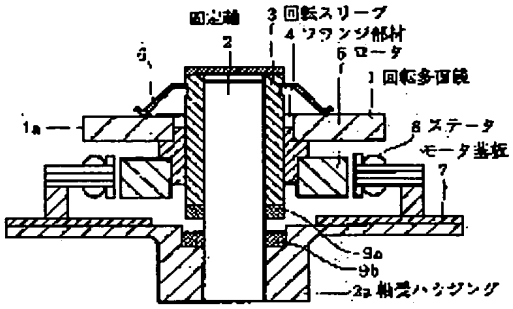
(54) DYNAMIC PRESSURE BEARING AND DEFLECTION SCANNER



(57)Abstract:

PROBLEM TO BE SOLVED: To prevent the damage of a dynamic pressure bearing made of ceramics in case an environment temperature falls.

SOLUTION: A rotary polyhedral mirror 1 is integrated with a rotor 5 of a motor and a revolving sleeve 3 via a flange member 4. A stationary shaft 2 and the revolving sleeve 3 are made of alumina which are inexpensive ceramics and the flange member 4 is formed of an aluminum material, by which the tensile stresses generated in the revolving sleeve 3 by the shrinkage of the flange member 4 in a low-temperature stage are decreased and the bearing damage by cracking is prevented.

LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] The hydrodynamic bearing which the construction material of the flange material combined with the shank material and sleeve member which fit in free [a revolution] mutually, and said shank material or said sleeve member in one, said shank material which has a driving means for rotating this flange material, and was combined with said flange material, or said sleeve member is the ceramics which uses an alumina as a principal component, and is characterized by making said flange material from aluminum material.
[Claim 2] flange material -- burning -- inserting in -- the hydrodynamic bearing according to claim 1 characterized by being combined with shank material or a sleeve member.
[Claim 3] The maximum tensile stress generated in shank material or a sleeve member when rotating flange material by the driving means is 2 12kg/mm. Hydrodynamic bearing according to claim 1 or 2 characterized by being constituted so that it may become below.
[Claim 4] The rotating polygon which carries out the deflection scan of the light beam, and the flange material combined with said rotating polygon by the coupling means, The hydrodynamic bearing which has the shank material or sleeve member combined with this flange material in one, It has a driving means for rotating said rotating polygon through said flange material. The deflection scanner which the construction material of said shank material combined with said flange material or said sleeve member is the ceramics which uses an alumina as a principal component, and is characterized by making said flange material from aluminum material.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the hydrodynamic bearing and deflection scanner which are used for the actuator of the deflection scanner carried in image formation equipments, such as a laser beam printer and laser facsimile.

[0002]

[Description of the Prior Art] By the rotating polygon which carries out a high-speed revolution, the deflection scanner used for image formation equipments, such as a laser beam printer and laser facsimile, etc. reflects light beams, such as a laser beam (laser beam), carries out image formation of the obtained scan light to the photo conductor on a rotating drum, and forms an electrostatic latent image. Subsequently, printing (print) is performed by developing the electrostatic latent image of a photo conductor in a toner image with a developer, imprinting this to record media, such as the recording paper, and carrying out heating fixation of the toner on delivery and a record medium to an anchorage device.

[0003] Drawing 5 is what shows the body of the deflection scanner by the 1 conventional example. This The flange material 104 is united with the revolution sleeve 103 which fits into the fixed shaft 102. While fixing Rota 105 to this flange material 104, pressing a rotating polygon 101 to the flange material 104 by the presser bar spring 106 and making it combine with this in one Motor housing 102a which fixed the fixed shaft 102 was made to support the motor substrate 107, and Rota 105 counters the stator 108 set up on the motor substrate 107, and constitutes with this the motor which is a driving means. This motor is exciting a stator 108 and rotates Rota 105 and a rotating polygon 101 in one.

[0004] The revolution sleeve 103 forms the air film between the fixed shafts 102 by

the revolution, and constitutes the hydrodynamic bearing which rotates by non-contact on the fixed shaft 102. 1st permanent magnet 109a fixed in the soffit of the revolution sleeve 103, and permanent magnet 109a has countered 2nd permanent magnet 109b which is motor housing 102a and one. The 1st and 2nd permanent magnet 109a and 109b supports the revolution sleeve 103 in the thrust direction according to the magnetic-repulsion force generated among both.

[0005] The fixed shaft 102 and the revolution sleeve 103 which constitute pneumatic bearing are made with the ceramic ingredient. moreover, the flange material 104 -- metal -- burning -- inserting in -- fixing to the revolution sleeve 103, Rota 105 has fixed to the flange material 104 by approaches, such as adhesion.

[0006]

[Problem(s) to be Solved by the Invention] According to the above-mentioned Prior art, the revolution sleeve and fixed shaft which constitute a hydrodynamic bearing are the ceramics. However, metal flange material Processing is a product made from brass at the point of it being comparatively easy, and it being strong and being easy to treat to the crack like an erector etc., in many cases, from the difference of the coefficient of linear expansion of the ceramics and brass, if environmental temperature becomes low, the flange material made from brass will contract and great stress will be applied to the bearing made from the ceramics.

[0007] When flange material is attached in the periphery of a revolution sleeve, in the attachment section of flange material, excessive tensile stress occurs in the inner skin of a revolution sleeve. On the other hand, in the hydrodynamic bearing of a type which rotates a shaft side, since it is the configuration of attaching flange material in a revolving-shaft side, big tensile stress occurs in a shaft surface near the part in which flange material was attached.

[0008] In order that reinforcement may fall compared with silicon nitride etc. depending on the class of ceramics, a crack will progress from the generating part of the maximum tensile stress, and a for example comparatively cheap alumina will result in fracture, if tensile stress becomes large.

[0009] Moreover, when burning as a mounting arrangement to the bearing of flange material and using eye **, breakage of bearing will be caused if not careful of the construction material of the ceramics which constitutes bearing, the mechanical physical-properties value of flange material, and the environment where burn and insert in and setting out of ** and a deflection scanner are used enough.

[0010] A resistance to environment aims at offering a high and long lasting highly efficient hydrodynamic bearing and a deflection scanner, without [therefore]

damaging the shank material and sleeve member made from the ceramics, even when this invention is made in view of the unsolved technical problem which the above-mentioned Prior art has and environmental temperature shifts to low temperature.

[0011]

[Means for Solving the Problem] In order to attain the above-mentioned object, the hydrodynamic bearing of this invention The flange material combined with the shank material and sleeve member which fit in free [a revolution] mutually, and said shank material or said sleeve member in one, The construction material of said shank material which has a driving means for rotating this flange material, and was combined with said flange material, or said sleeve member is the ceramics which uses an alumina as a principal component, and it is characterized by making said flange material from aluminum material.

[0012] flange material -- burning -- inserting in -- it is good to be combined with shank material or a sleeve member.

[0013] The maximum tensile stress generated in shank material or a sleeve member when rotating flange material by the driving means is 2 12kg/mm. It is good to be constituted so that it may become below.

[0014] The rotating polygon to which the deflection scanner of this invention carries out the deflection scan of the light beam, and the flange material combined with said rotating polygon by the coupling means, The hydrodynamic bearing which has the shank material or sleeve member combined with this flange material in one, The construction material of said shank material which has a driving means for rotating said rotating polygon through said flange material, and was combined with said flange material, or said sleeve member is the ceramics which uses an alumina as a principal component, and it is characterized by making said flange material from aluminum material.

[0015]

[Function] Breakage of the bearing by tensile stress when a temperature environment shifts to a low temperature side can be prevented by combining the flange material made from aluminum material with the hydrodynamic bearing made from the ceramics which uses an alumina (aluminum 2O3) as a principal component.

[0016] especially -- flange material -- burning -- inserting in -- reducing the tensile stress resulting from a thermal strain combining the small alumina and aluminum material of a difference of coefficient of linear expansion, since there is an inclination to be easy to cause breakage for the tensile stress which remains in the bond part

depended for burning and inserting in when combined with the shank material or sleeve member of a hydrodynamic bearing has big effectiveness, when raising the resistance to environment of bearing.

[0017] In addition, since the alumina is cheap compared with silicon nitride etc. also in the ceramics, it can contribute also to reduction of bearing cost greatly.

[0018] The reinforcement of a deflection scanner, low-pricing, etc. can be promoted by using such a hydrodynamic bearing for bearing of the rotating polygon of a deflection scanner.

[0019]

[Embodiment of the Invention] The gestalt of operation of this invention is explained based on a drawing.

[0020] Drawing 1 is what shows the body of the deflection scanner by the gestalt of 1 operation. This The flange material 4 is united with the revolution sleeve 3 which is the sleeve member which fits into the fixed shaft 2 which is shank material. While fixing Rota 5 to this flange material 4, pressing a rotating polygon 1 to the flange material 4 by the presser bar spring 6 and making it combine with this in one Motor housing 2a which fixed the fixed shaft 2 was made to support the motor substrate 7, and Rota 5 counters the stator 8 set up on the motor substrate 7, and constitutes with this the motor which is a driving means. This motor is exciting a stator 8 and rotates Rota 5 and a rotating polygon 1 in one.

[0021] The revolution sleeve 3 forms the air film between the fixed shafts 2 by the revolution, and constitutes the hydrodynamic bearing which rotates by non-contact on the fixed shaft 2. 1st permanent magnet 9a fixed in the soffit of the revolution sleeve 3, and permanent magnet 9a has countered 2nd permanent magnet 9b which is motor housing 2a and one. The 1st and 2nd permanent magnet 9a and 9b supports the revolution sleeve 3 in the thrust direction according to the magnetic-repulsion force generated among both.

[0022] In addition, the presser bar spring 6 which presses a rotating polygon 1 to the flange material 4 is a spring of a pan form attached to the side face of the flange material 4, among those a periphery is stopped by the circular sulcus of the flange material 4, and a periphery edge is pressed by the top face of a rotating polygon 1.

[0023] The fixed shaft 2 which constitutes pneumatic bearing, and the revolution sleeve 3 are made with the ceramics which uses an alumina (aluminum 2O3) as a principal component. moreover, the flange material 4 -- the product made from aluminum -- burning -- inserting in -- it fixes to the revolution sleeve 3 and Rota 5 is united with the flange material 4 by approaches, such as adhesion.

[0024] It is the ceramics with which the construction material of the fixed shaft 2 which is the shank material which the flange material 4 is made from aluminum material, and constitutes the hydrodynamic bearing made from the ceramics, and the revolution sleeve 3 uses an alumina as a principal component. The difference of the coefficient of linear expansion of aluminum material and an alumina can avoid that big tensile stress occurs in the inner skin of the revolution three 3 etc. by contraction of the flange material 4, when a temperature environment shifts to low temperature, since it is small compared with the case where the brass and the silicon nitride like for example, the conventional example are combined etc.

[0025] That is, when a temperature environment shifts to low temperature compared with the case where brass is combined and used for the bearing and the flange material of the alumina to which reinforcement falls from silicon nitride by using an alumina combining the flange material of the hydrodynamic bearing made from the ceramics, and the product made from aluminum used as a principal component etc., it is eased and the tensile stress generated in a hydrodynamic bearing in the bond part of flange material has effectiveness in preventing breakage of bearing. By this, it excels in the resistance to environment and a moreover very highly efficient hydrodynamic bearing can be realized.

[0026] In addition, bearing cost can be substantially reduced by using a comparatively cheap alumina compared with silicon nitride etc. also in the ceramics.

[0027] By carrying such a hydrodynamic bearing, it can contribute to improvement and high-performance-izing of the endurance of a deflection scanner.

[0028] moreover, the revolution section and the flange material of bearing -- burning -- inserting in -- since it is combined in one, when it was made to rotate at high speed, or even when it is used in a hot temperature environment, the stable motor balance can be maintained. That is, the noise to which it comes from the imbalance of the motor at the time of motorised, the unevenness of an image, etc. can be reduced.

[0029] When a temperature environment shifts to a low temperature side, contraction of flange material can ask the tensile stress which the inner circumference section of the revolution sleeve made from an alumina is made to generate for the configuration of flange material, and the maximum tensile stress to the revolution sleeve made from an alumina which will be applied to revolution sleeve inner circumference if it burns and inserts in and computes by simulation from **.

[0030] The bearing for a trial which the maximum tensile stress computed in simulation by computing the maximum tensile stress value shown in the table of (a) of drawing 4 , flange material burning, inserting in by furthermore giving and calculating a

temperature change using actual bearing, setting up **, and setting up a temperature environment further produces was produced 208 totals. The graph of (b) of drawing 4 was obtained in quest of the probability for the bearing for a trial to result in destruction then.

[0031] The tensile stress which considers the error on production of the bearing for a trial and the precision of count, and is generated in the bearing made from an alumina from this graph is 2 12 kgf(s)/mm. Breakage of bearing can be prevented if it designs that it is the following. That is, it turns out that the hydrodynamic bearing to which the dependability as bearing does not fall by change of a temperature environment is realizable.

[0032] Drawing 2 shows the example of a complete-change form. This rotates shank material and a rotating polygon 1 and Rota 5 are combined with the revolving shaft 12 which is the shank material made from an alumina in one through the flange material 14 made from aluminum using the hydrodynamic bearing of the axial revolution mold which fixed the sleeve member. Fitting of the revolution of a revolving shaft 12 is made free to the fixed sleeve 13 which is a sleeve member made from an alumina, and permanent magnet 19a attached in the soffit of a revolving shaft 12 and permanent magnet 19b fixed to the soffit of the fixed sleeve 13 are repelled mutually, and constitutes thrust bearing.

[0033] It is fixed to bearing housing 2a, and a rotating polygon 1 is pressed by the presser bar spring 6, and the fixed sleeve 13 is united with the flange material 14 made from aluminum. If the stator 8 on the motor substrate 7 is excited, Rota 5 rotates, revolution actuation of the revolving shaft 12 will be carried out through the flange material 14 made from aluminum, and a rotating polygon 1 will be rotated.

[0034] Thus, also in the case of the hydrodynamic bearing of an axial revolution mold, by combining the revolving shaft made from the ceramics which uses as a principal component the flange material made from aluminum material, and an alumina, the tensile stress generated in a hydrodynamic bearing can be eased, and breakage of bearing can be prevented. Moreover, by using a cheap alumina, low cost-ization of the hydrodynamic bearing made from the ceramics is promoted, and a deflection scanner very highly efficient and cheap moreover can be realized.

[0035] Drawing 3 shows the whole deflection scanner, and this has the light source 51 which generates light beams (flux of light), such as a laser beam, and cylindrical-lens 51a which makes reflector 1a of a rotating polygon 1 condense said light beam to a line, by the revolution of a rotating polygon 1, it carries out a deflection scan and carries out image formation of said light beam to the photo conductor 54 on a rotating

drum through the image formation lens system 52 and the clinch mirror 53. The image formation lens system 52 has spherical-lens 52a, toric lens 52b, etc., and has the so-called ftheta function which amends the scan speed of **** which carries out image formation to the photo conductor 54 on a rotating drum etc.

[0036] If a rotating polygon 1 rotates by said motor, the reflector 1a will rotate at uniform velocity to the circumference of the axis of a rotating polygon 1. It is generated from the light source 51 as mentioned above, and since the angle which the optical path of a light beam and the normal of reflector 1a of a rotating polygon 1 which are condensed by cylindrical-lens 51a make, i.e., the incident angle of the light beam to this reflector 1a, changes with time with the revolution of a rotating polygon 1 and angle of reflection changes similarly, **** made by condensing a light beam on a photo conductor 54 moves to the shaft orientations (main scanning direction) of a rotating drum.

[0037] The image formation lens system 52 is designed so that the scan speed to the main scanning direction of this **** may be maintained at uniform velocity, while condensing the light beam reflected in the rotating polygon 1 to **** of a spot configuration predetermined in a photo conductor 54 top.

[0038] **** which carries out image formation to a photo conductor 54 forms an electrostatic latent image in connection with horizontal scanning by the revolution of a rotating polygon 1, and vertical scanning by a photo conductor 54 rotating to the circumference of the shaft of a rotating drum.

[0039] The developer for developing the electrostatic latent image formed in the electrification equipment for being charged uniformly and the front face of a photo conductor 54 in the front face of a photo conductor 54 in a toner image, the imprint equipment which imprints said toner image on the detail paper are arranged around the photo conductor 54, and the recording information by the light beam generated from the light source 51 is printed on the detail paper etc.

[0040] The detection mirror 55 reflects a light beam at the improvement style side in the method of horizontal scanning rather than the optical path of the light beam which carries out incidence to the write-in starting position of the recording information in the front face of a photo conductor 54, and introduces it into the light-receiving side of the photo detector 57 which has a photodiode etc. through a lens 56. A photo detector 57 outputs the write-in start signal for controlling a write-in starting position (beginning location), when the light-receiving side is irradiated by said light beam.

[0041] The light source 51 generates the light beam corresponding to the signal given from the processing circuit which processes the information from a host computer.

The signal given to the light source 51 supports the information which should be written in a photo conductor 54, and a processing circuit is given to the light source 51 by making into one unit the signal showing the information corresponding to the 1 scanning line which is the locus which **** which carries out image formation in the front face of a photo conductor 54 makes. This information signal is transmitted synchronizing with the write-in start signal given from a photo detector 57.

[0042] In addition, a rotating polygon 1 and image formation lens system 52 grade are held in the optical box 50, and light source 51 grade is attached in the side attachment wall of the optical box 50. After attaching a rotating polygon 1 and image formation lens system 52 grade to the optical box 50, it equips with the cover which is not illustrated to up opening of the optical box 50.

[0043]

[Effect of the Invention] Since this invention is constituted as mentioned above, effectiveness which is indicated below is done so.

[0044] In the hydrodynamic bearing made from the ceramics, while using the ceramics which uses an alumina as a principal component, the bearing breakage by contraction of flange material when a temperature environment shifts to a low temperature side can be effectively prevented by combining the flange material made from aluminum. Moreover, it can contribute to low cost-ization of a hydrodynamic bearing and a deflection scanner by using a comparatively cheap alumina also in the ceramics.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is partial type section drawing showing the body of the deflection scanner by the gestalt of 1 operation.

[Drawing 2] It is partial type section drawing showing the example of a complete-change form.

[Drawing 3] It is the ** type top view showing the whole deflection scanner.

[Drawing 4] It is the table and graph which show the probability of a work piece and the relation of the maximum tensile stress to damage.

[Drawing 5] It is partial type section drawing showing the 1 conventional example.

[Description of Notations]

1 Rotating Polygon

2 Fixed Shaft

3 Revolution Sleeve

4 14 Flange material

5 Rota

8 Stator

9a, 9b, 19a, 19b Permanent magnet

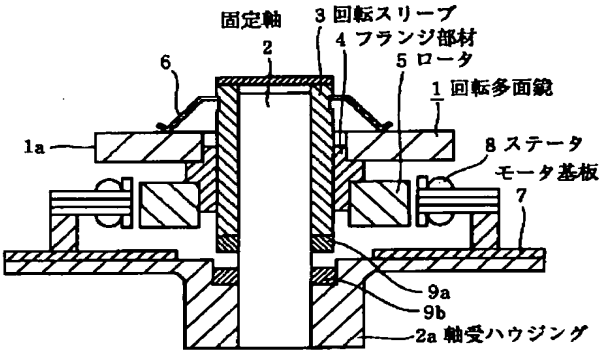
12 Revolving Shaft

13 Fixed Sleeve

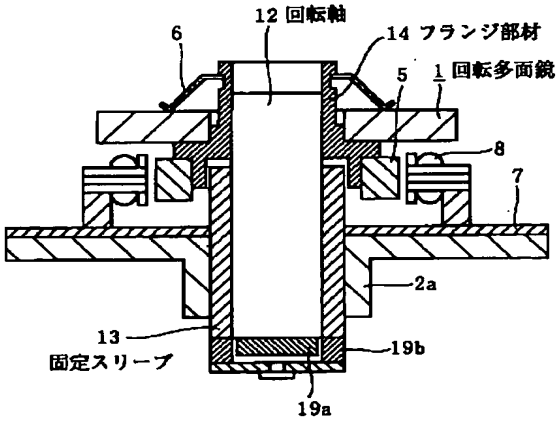
[Translation done.]

DRAWINGS

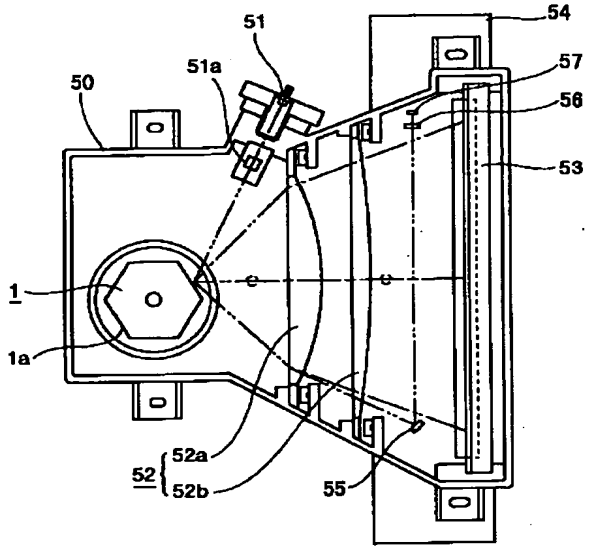
[Drawing 1]



[Drawing 2]



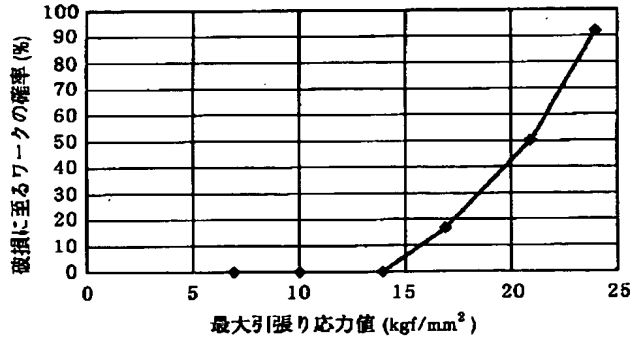
[Drawing 3]



[Drawing 4]

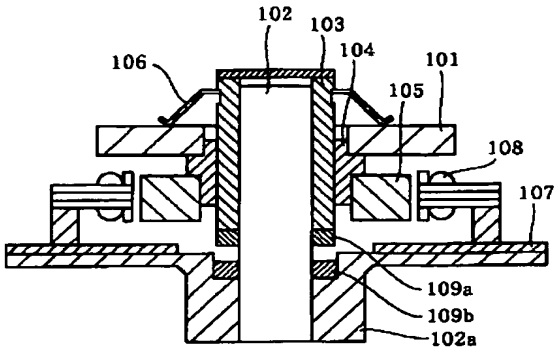
最大引張り応力値 (kgf/mm^2)	7	10	14	17	21	24
破損確率 (%)	0	0	0	17	50	92

(a)



(b)

[Drawing 5]



[Translation done.]